

Appl. No. 10/715,492
Amdt. dated May 19, 2005
Reply to Office Action of January 25, 2005

Amendments to the Specification:

Please replace the following paragraph beginning on page 2, line 25, with the following rewritten paragraph:

In a preferred embodiment of the invention, a novel process of sulfur oxide sorption is provided, wherein a gas containing sulfur oxide is contacted at elevated process temperature ~~for example of~~ from about 200°C up to about 750°C, with a solid phyllosilicate sorbent material to remove sulfur oxide from the gas. A preferred solid phyllosilicate sorbent material comprises crystalline materials having alternating silicate layers and layers having a brucite crystalline structure containing divalent and trivalent metal oxides comprising predominantly magnesia and alumina present in the brucite structure. The amount of phyllosilicate in the solid sorbent can vary from about 10 to 100 wt%. A preferred sorbent composition comprises a mixture of 10 to 90 parts by weight of magnesia-rich chlorite containing about 10-30 weight percent MgO and 10 to 90 parts by weight of hydrotalcite containing at least 50 weight percent MgO. Sulfur oxide sorption and/or desorption may be enhanced by incorporating the catalyst composition, a solid sorbent material having an effective amount of a metal oxide disposed thereon. Representative metal oxides include cerium, vanadium and platinum in ~~amounts for example of about 50 to 500 ppm~~ an effective amount.

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Please replace the following paragraph beginning on page 3, line 16, with the following rewritten paragraph:

The chlorite group of crystalline materials is often not considered a part of the genus of clays and is sometimes left alone as a separate group within the phyllosilicate structures. It is a relatively large and common group of materials although its members are not especially widely well known. Some of the recognized members of this group of materials include: Amesite, Baileychlore, Chamosite, Clinochlore, Cookeite, Corundophilite, Gonyerite, Nimite, Odinite, Orthochamosite, Penninite, Pannantite, Rhipidolite, (prochlore), Sudoite, and Thuringite. The term chlorite is often used to denote any member of this group when differentiation between the different members is not possible or needed. The general formula is $X_{4-6}Y_4O_{10}(OH, O)_8$. The X represents ~~at least one of~~ aluminum, iron, lithium, magnesium, manganese, nickel, zinc or ~~sometimes~~ chromium. The Y represents aluminum, silicon, boron or iron, but usually aluminum/or and silicon.

Please replace the following paragraph beginning on page 4, line 10, with the following rewritten paragraph:

The magnesia-rich contact solids made according to this invention may be self-bound or may include a binder component to hold the inorganic compounds together in the desired shape, such as spheroidal particles. Depending on the application, different binding systems can be used, and binders may be added to milled metal oxides/salts prior to forming them into an aqueous

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slurry. For example, in more severe high temperature applications, such as fluid cracking catalyst (eg-700-820°C), a hydrothermally stable inorganic binder such as aluminum chlorohydrol or peptized alumina ~~is preferably~~ may be used. Effective inorganic binders include sols of aluminum such as aluminum chlorohydrol, peptized aluminas, sols of silica, colloidal silicas, sols of titanium, sols of zirconium clays such as bentonite, calcined kaolinite, kaolinite, metakaolin, montmorillonite, low-magnesia chlorites, talc, and mixtures of these. Preferred inorganic binders include a sol of aluminum, peptized alumina, a sol of silica, colloidal silica, a sol of titanium, a sol of zirconium, a clay, and mixtures thereof.

Please replace the following paragraph beginning on page 4, line 26, with the following rewritten paragraph:

Finely-divided milled solids components are mixed with water, preferably containing about 0.1 to 1 wt% surfactant, ~~such as~~ comprising acid stable fluorohydrocarbon, prior to forming and drying the contact solids product of this invention. It may be advantageous to provide pre-blended, dry-milled materials for dispersion in water which will then be spray dried or otherwise manufactured into dry particles in a short time period. Hydrolyzable metal oxides and salts are advantageously pre-blended and stored in the substantial absence of added water. Batch or continuous inline feeding of slurry components is well known. Thereafter, the slurry is pumped or otherwise transported to a spray dryer feed tank.

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Please replace the following paragraph beginning on page 6, line 6, with the following rewritten paragraph:

The contact solid composition may be self-bound or may include a binder component to hold the inorganic oxide particles together into the desired shape, such as spheroidal particles. Depending on the application, different binding systems are used. For example, in more severe high temperature applications, such as fluid cracking catalyst (e.g.- 700-820 C), a hydrothermally stable inorganic binder such as aluminum chlorohydrol or peptized alumina ~~is preferably~~ may be used.

Please replace the following paragraph beginning on page 7, line 22, with the following rewritten paragraph:

The catalyst composition is desirably formed into a fluidizable particle having an average particle size in the range of about 20 μ -300 μ , that is useful in both conventional fluidized bed and ebullating bed processes. The SO_x-capturing oxide of the invention is desirably a magnesia-rich solid and/or mixed inorganic oxide additive for catalyzing the capture and release of sulfur-containing compounds in the fluid cracking catalyst. In a preferred embodiment, the SO_x-capturing additive is a solid sorbent material contains hydrotalcite consisting predominately of magnesia. This provides refiners with an effective means for reducing SO_x emissions, especially from an FCC unit regenerator. The invention provides a contact solids or catalyst composition employed as a formed spheroidal catalyst that reduces the emissions of sulfur containing

compounds from industrial processes. For example, in the preferred embodiment of the invention, the MgO-rich phyllosilicate captures and thereby removes the sulfur containing species, such as H_2S or SO_x that is present in the gas stream being heated. Advantageously, this invention is employed to reduce emissions of sulfur compounds from a fluid cracking catalyst (FCC) process especially a catalyst regenerator used in conjunction with the fluid bed cracking operation. Particulate solids are added to the FCC unit in the same manner as the conventional cracking catalyst (e.g.- REY zeolite). The magnesia-rich brucitic additive can be introduced separately or together in a mixture with the cracking catalyst. Usually the addition is accomplished by a pneumatic conveying system to blow the material directly into the FCC catalyst regenerator. The catalyst additive then circulates through the fluid cracking catalyst unit in direct contact and along with the fluid cracking catalyst. The quantity of fluid cracking catalyst additive that is added and which then circulates in the unit is sufficient to effectively reduce the emissions of sulfur containing compounds from the FCC unit, yet it should not be present in a proportion so large that it deleteriously affects the operation of the cracking process reactions. Fluid cracking catalyst additive level of between about 0.5 and about 10 weight percent of the circulating fluid cracking catalyst inventory is desirable.

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Please replace the following paragraph beginning on page 12, line 19, with the following rewritten paragraph:

According to the present invention, it is advantageous to employ solid sorbent material comprising at least one layered magnesia-rich crystalline material containing layers of brucite structure, wherein the brucite material is predominately magnesia, having an average MgO content of at least about 50wt%, particularly wherein the sorbent comprises a mixture of magnesia-rich chlorite and hydrotalcite in a weight ratio of about 10:90 to ~~90:0~~ 90:10 chlorite:hydrotalcite.